Q- An aluminum block is pushed to the right with and initial speed of $v=10 \mathrm{ft} / \mathrm{s}$ at the same time a copper block is pushed to the left with an initial speed of $v=16 \mathrm{ft} / \mathrm{s}$. both blocks slide along a horizontal steel floor toward each other. if the blocks were initially 10 ft . apart determine how far each block slides before they collide. the kinetic friction for the aluminum block $=0.47$ and the kinetic friction for the copper block $=0.36$.

Time of motion for both blocks is the same, say it is $t$. When a body moves on a horizontal surface the normal reaction $N$ is equal to its weight mg and friction force $\mathrm{F}=-\mu \mathrm{N}=-\mu \mathrm{mg}$. Hence acceleration of the body will be $-\mu \mathrm{g}$.

For aluminum block Initial velocity $u=10 \mathrm{ft} / \mathrm{s}$ Acceleration $\mathrm{a}_{1}=-\mu \mathrm{g}=-0.47 * 32=-15.04 \mathrm{ft} / \mathrm{s}^{2}$.

Hence distance covered in time $t$ is given by the second equation of motion as
$\left\{s=u t+1 / 2 a^{2}\right\}$
or $\quad s_{1}=10 * t+0.5^{*}(-15.04) t^{2}=10 * t-7.52 * t^{2}$
Similarly the distance covered by the copper block towards left is given by Initial velocity $u=16 \mathrm{ft} / \mathrm{s}$
Acceleration $\mathrm{a}_{2}=-\mu^{\prime} \mathrm{g}=-0.36 * 32=-11.52 \mathrm{ft} / \mathrm{s}^{2}$.
Hence distance covered in time $t$ is given by the second equation of motion as

$$
\left\{s=u t+1 / 2 a^{2}\right\}
$$

or $\quad s_{2}=16 * t+0.5^{*}(-11.52) t^{2}=16 * t-5.76 * t^{2}$
As we know that the totals distance covered by both is 10 ft hence

$$
10=16 * \mathrm{t}-5.76 * \mathrm{t}^{2}+10 * \mathrm{t}-7.52 * \mathrm{t}^{2}
$$

or

$$
13.28 t^{2}-26 t+10=0
$$

Using this formula for solution of quadratic equation we get

$$
t=\frac{26 \pm \sqrt{26^{2}-4 * 13.28 * 10}}{2 * 13.28}=\frac{26 \pm \sqrt{144.8}}{26.56}
$$

gives $\mathrm{t}=1.432 \mathrm{~s}$ and $\quad \mathrm{t}=0.526 \mathrm{~s}$
After collision the motion will not in the same pattern we have to take the shortest time and hence the time elapses before collision is 0.526 s

Distance covered by the aluminum block before collision will be

$$
s_{1}=10 * t-7.52 * t^{2}=5.26-2.08=3.18 \mathrm{ft}
$$

And distance covered by the copper block before collision will be

$$
s_{2}=16 * t-5.76 * t^{2}=16 * 0.526-5.67 * 0.526^{2}=8.41-1.59=6.82 \mathrm{ft}
$$

